

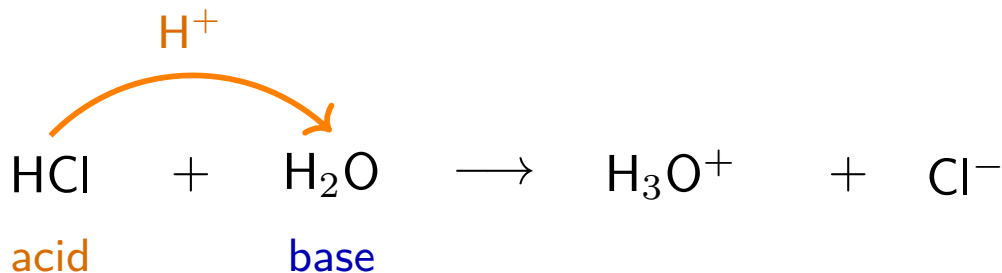
Exercise walk-through

7.2

Brønsted–Lowry theory of acids and bases

A-Level Chemistry

Brønsted–Lowry acids and bases



conjugate acid–base pairs:
 HCl / Cl^- and $\text{H}_2\text{O} / \text{H}_3\text{O}^+$

- an **acid** is a **proton donor**
- a **base** is a **proton acceptor**

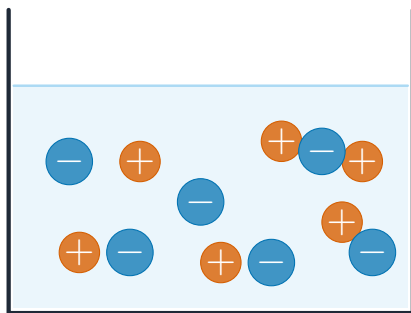
The reaction makes two
conjugate acid–base pairs.

Strong and weak acids

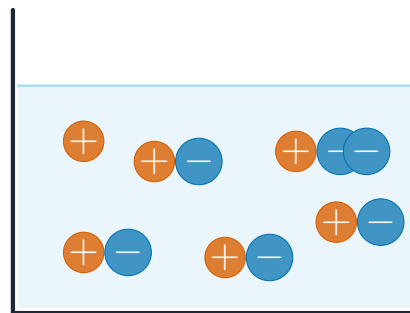
This is about **ionisation**, not concentration:

- **strong acid** – fully **dissociated**
- **weak acid** – only partly dissociated

A strong acid has a lower pH & conducts better.



strong acid



weak acid

fully dissociated: many ions mostly molecules: few ions

Bronsted-Lowry, and telling strong from weak

an acid

a **proton donor** – it gives H^+

a base

a **proton acceptor**
water is an **alkali**

– it takes H^+ . A base that dissolves in water

the acids to know

hydrochloric HCl , sulfuric H_2SO_4 , nitric HNO_3 , and ethanoic CH_3COOH

a strong base

fully dissociated – NaOH , KOH ; a **weak base** partly

such as ammonia only

test 1: reactive metal

a **strong** acid fizzes faster at the same concentration

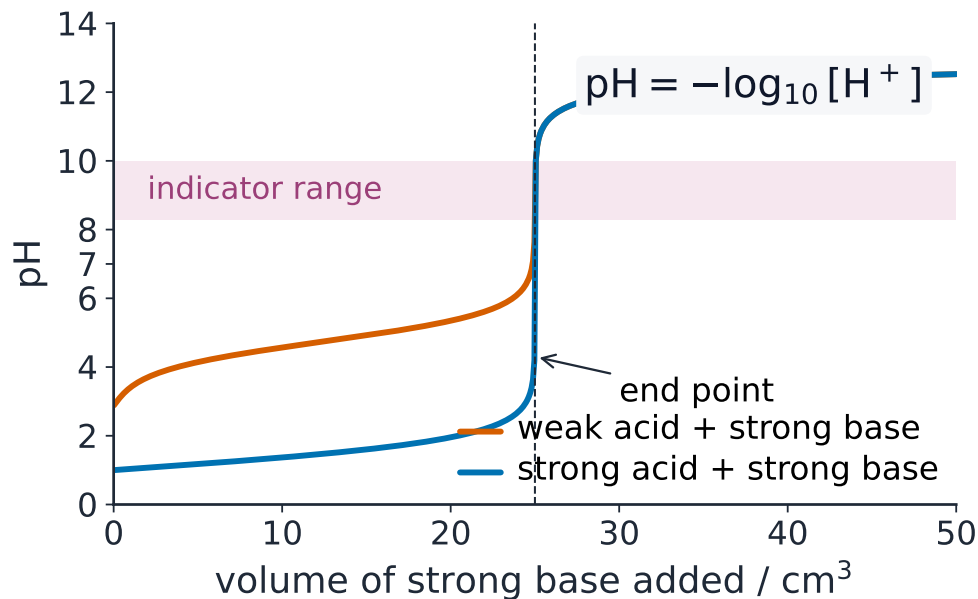
test 2: pH

measured with a pH meter or **universal indicator**
acids give a lower pH at equal concentration

– strong

Strong is about how far it dissociates; **concentrated** is about how much is dissolved. A concentrated weak acid is entirely possible.

Titration curves



Neutralisation : $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$, forming a **salt** .

A **titration curve** has a steep pH jump at the end point – pick an **indicator** that changes colour inside it.

Neutralisation and the shape of a titration curve

neutralisation

$\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$ – the same ionic equation whichever acid and alkali

a titration

add one solution to another and follow the pH

the titration curve

has a **steep, almost vertical** section at the end point

strong–strong

the vertical section is long, and centred near pH 7

weak acid–strong base

shorter, and centred **above** 7; the reverse case is centred below it

choosing an indicator

its colour change must fall **inside** the vertical section

The indicator is chosen from the *curve*, not from the acid. That is why phenolphthalein suits a weak acid and methyl orange does not.

Exercises 2.1·2.2

2.1 Define a Brønsted–Lowry **acid** and **base**.

[2]

2.2 State the difference between a strong acid and a weak acid.

[2]

Exercises 2.1·2.2

2.1 Define a Brønsted–Lowry **acid** and **base**.

[2]

2.1

- an acid is a proton (H^+) donor; a base is a proton acceptor

2.2 State the difference between a strong acid and a weak acid.

[2]

2.2

- a strong acid is fully dissociated into ions in water; a weak acid is only partly dissociated

Exercises 3.1·3.2

3.1 In the Brønsted–Lowry theory, a base is a:

[1]

☐

- A proton donor
- B proton acceptor
- C electron donor
- D electron acceptor

3.2 Compared with a weak acid of the same concentration, a strong acid has a:

[1]

☐

- A higher pH
- B lower pH and more ions
- C smaller volume
- D larger molar mass

Exercises 3.1·3.2

3.1 In the Brønsted–Lowry theory, a base is a:

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3.1 B

- A base is a proton acceptor

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[1]

☐

- A higher pH
- B lower pH and more ions
- C smaller volume
- D larger molar mass

3.2 B

- A strong acid is fully dissociated, giving more ions and a lower pH

Exercise 3.3

3.3 (a) Write the ionic equation for the neutralisation of an acid by an alkali. [1]

(b) Explain why a strong acid conducts electricity better than a weak acid of the same concentration. [2]

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(b) Explain why a strong acid conducts electricity better than a weak acid of the same concentration. [2]

3.3

(a)



(b)

- a strong acid is fully dissociated, so has more ions; more ions carry more charge, so it conducts better

Exercise 3.4

3.4 Explain how you would use a pH meter and a reactive metal to show that hydrochloric acid is a stronger acid than ethanoic acid of the same concentration. [3]

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3.4

- measure the pH of each with a pH meter – HCl gives a lower pH; add the same reactive metal to each – HCl fizzes faster; both show HCl has more H^+ ions / is more dissociated, so it is stronger